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RESEARCH REPORT

JOINT COMMAND AND CONTROL - SEARCH FOR THE HOLY GRAIL

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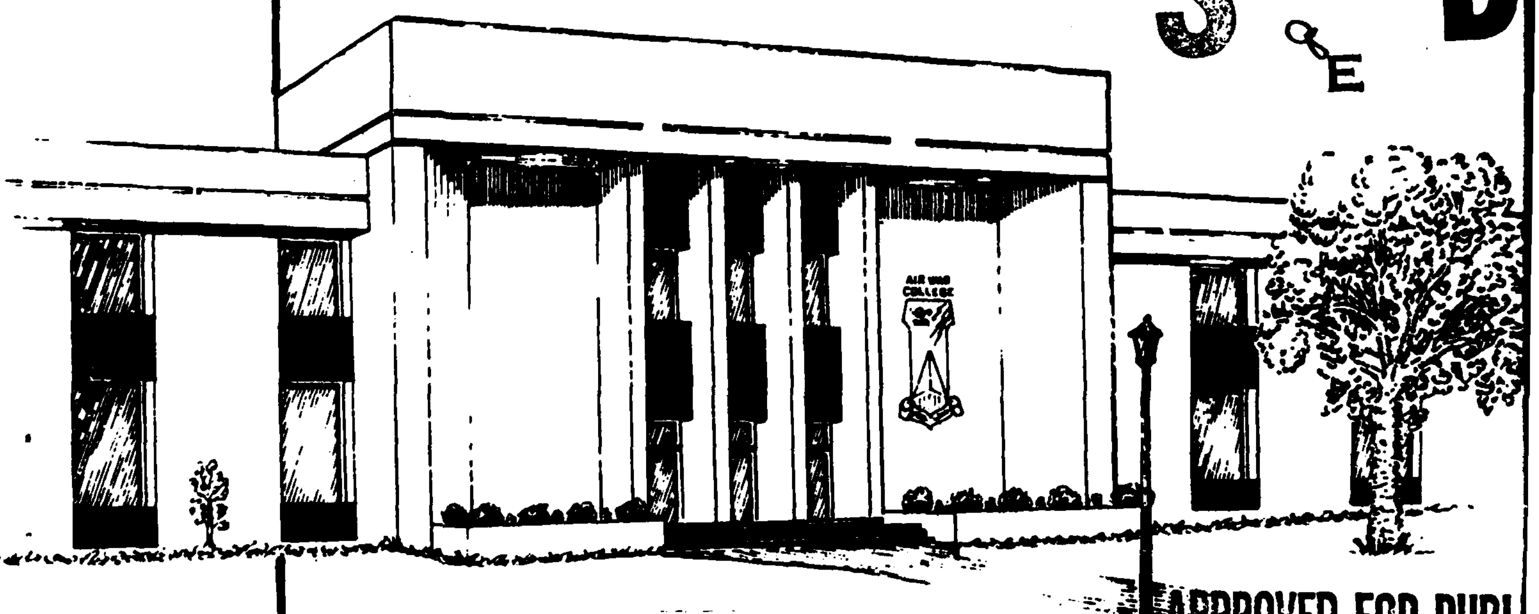
1988



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JOINT COMMAND AND CONTROL - SEARCH FOR THE HOLY GRAIL

by

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A RESEARCH PROJECT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE RESEARCH

REQUIREMENT

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AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE : Joint Command and Control - Search for the Holy Grail

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Joint command and control (C^2) is essential for joint forces to work effectively in low-intensity conflicts or in global nuclear war. C^2 process functions are the same for all warfare levels and C^2 systems to support them are generically similar. Much of the recent criticism of joint C^2 systems has concentrated on equipment interoperability and fixes but relatively little attention has been given to the C^2 process, the impact of the process on a C^2 system or the resultant effect of specific communications requirements. This paper explains essential elements of the C^2 process - SEE, DECIDE, ACT - and relates the process functions to C^2 systems requirements. Specific procedural enhancements and adjustments to existing C^2 systems are provided that can significantly improve C^2 interoperability (and, therefore, combat effectiveness) for joint and combined operations. (KR)

BIOGRAPHICAL SKETCH

Lieutenant Colonel Robert J. Brooks (M. A. , George Washington University) has worked in command and control as an air weapons controller and communicator since entering the Air Force in 1969. He has served as a radar squadron commander and operations officer and as Command and Control Requirements officer at Tactical Air Command Headquarters. He is a graduate of the Armed Forces Staff College and the National Security Management course. His most recent assignment was as a Command and Control Evaluator and Interoperability Evaluator in the Organization of the Joint Chiefs of Staff. Lieutenant Colonel Brooks is a graduate of the Air War College, class of 1988.

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JOINT COMMAND AND CONTROL - SEARCH FOR THE HOLY GRAIL

The only purpose for joint command and control (C^2) procedures and systems is to make joint forces more effective in carrying out their missions. If joint C^2 doesn't work, then jointness in other military areas is largely irrelevant (16:17).

Effective C^2 is essential in support of maintaining our own security, supporting coalition security with our allies, and resolving disputes around the world where U. S. interests are affected. Joint and combined C^2 is equally critical for quick reaction, low-intensity conflict and for global nuclear war. C^2 process functions are the same for all warfare levels and C^2 systems to support them are generically similar.

Interoperability of joint C^2 systems in contingency operations has come under a great deal of criticism in the last few years. Much of that attention has been aimed at the communications equipment and associated communications security (COMSEC) equipment available to support joint operations. Relatively little attention has been given to the C^2 process,

the impact of the process on a C^2 system or the resultant effect on specific communications requirements.

This paper attempts to shed some light on these areas by explaining essential elements of the C^2 process, relating the process functions to C^2 systems requirements, and providing specific enhancements and adjustments to existing C^2 systems that can significantly improve C^2 interoperability (and, therefore, combat effectiveness) for joint and combined operations across the spectrum of conflict.

C2 PROCESS

C^2 is defined in JCS Pub 1 as "The *exercise of authority and direction* by a properly designated commander over assigned forces in the accomplishment of his mission. Command and control functions are performed *through an arrangement* of personnel, equipment, communications, facilities and procedures *employed by a commander* . . ." (Italics added). The C^2 process is independent of equipment, communications or facilities but requires that a commander 1) SEE a situation, 2) DECIDE what to do about it, and 3) ACT to affect the situation. This process is modeled in Figure 1 on the next page.

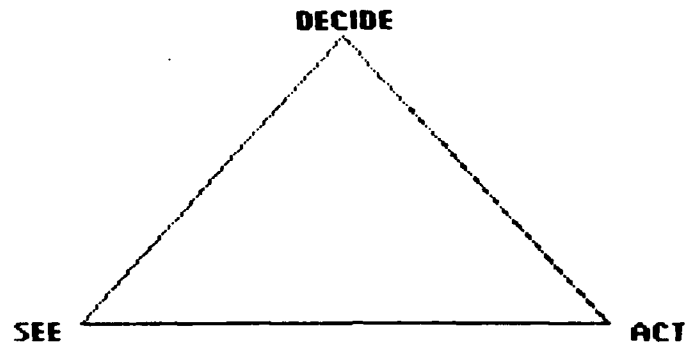

Figure 1

The C^2 process is basically a concentrated way of problem-solving. The selection of a model is important as a guide through that process. A criticism of many existing C^2 models is that they don't effectively consider the collection of friendly information. Some models are also not broad enough in their description of the decision phase. Still others neglect the importance of feedback. Most don't address the fact that the C^2 process extends over several cycles and over several organizational levels at any one time. The model in Figure 1 was developed to resolve those criticisms.

TO SEE - A commander needs to know what is happening on or near the battlefield. A clear picture of events is necessary that includes such items as status of friendly and enemy forces and enemy intentions. Figure 2 shows the basic steps to get from raw data to some degree of analyzed intelligence/information suitable for decisionmaking.

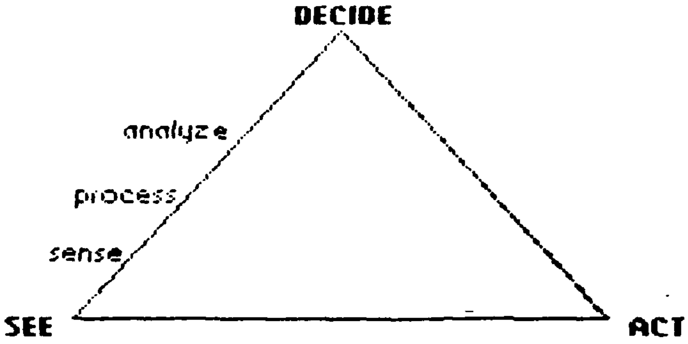

Figure 2

a. The SENSE function includes all data-gathering activities (radar sensors, observer reports, intelligence collection, friendly force information through feedback channels, etc.). This collection activity is driven by standard surveillance and by friendly force collection management tasking (e.g. watch for certain enemy electronic activity in such-and-such a vicinity, run a photo reconnaissance mission over these coordinates (following a strike), report mission results). Environmental information (weather, maps, charts, geodetic data) is also important.

b. The PROCESS function correlates and filters data to "package" similar information (e.g. multiple radar sensors feeding into a filter center), develops reconnaissance photos, and generally tries to attach some informational value or meaning to the raw data. Most friendly reports such as SITREPS would already be considered as processed and would go direct to the decisionmaker. Some of the more time-critical

processed enemy material may also be presented directly to the decisionmaker as well as go through the analysis phase.

c. The ANALYZE function fuses all available enemy information into a coordinated and assessed intelligence estimate of the current situation and probable future enemy actions (11:28). With the presentation of this collective information to the commander/decisionmaker, the "**SEE**" leg of the triangle is complete.

TO DECIDE - "If it makes no difference where you're going, then it doesn't matter how you get there." (Alice in Wonderland) What the cat told Alice should be a constant reminder to commanders and other decisionmakers. The name will change based on the organization, but a clear understanding of what "winning" means is needed before deciding on the right course of action. Every campaign plan has decision points, explicit or implicit, where key choices must be made (8:34) toward the final objective. As Clausewitz said, "War, in its highest forms, is not an infinite mass of minor events . . . War consists rather of single, great decisive actions each of which needs to be handled individually." (2:153). Commanders should design campaign plans with alternative objectives and position forces to take full advantage of enemy weaknesses when those key choices are made (11:50). (This certainly sounds like Sherman's "horns of a dilemma" and Hart's "indirect approach"!)

The commander reviews the perceived situation, compares it with the desired objective (using the campaign plan as a guide), and chooses to maintain/adjust current activities and battle strategy or change to an alternative course of action. Whichever path is chosen, the C^2 process continues on the right leg of the triangle as shown in Figure 3.

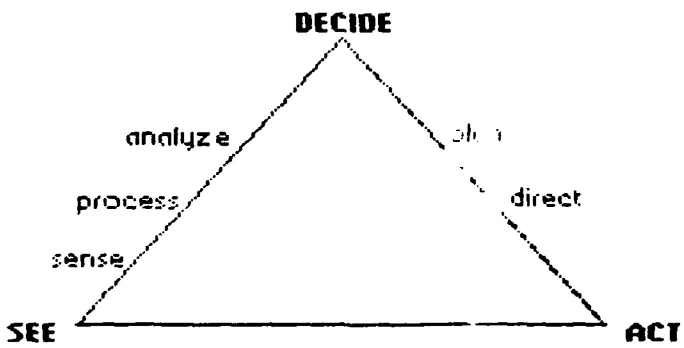

Figure 3

a. The PLANNING function doesn't really "begin" every time the cycle goes around. Planning is, indeed, a continuous activity. The commander's main input at this stage is to take the analyzed information and predictions, blend it with additional guidance from higher headquarters and ensure that existing plans are adjusted, as necessary, to fit the new reality. Courses of action are considered, objectives are identified to carry out in future operations, and orders are written and coordinated. After final review by the commander, the plan is sent out.

b. The DIRECTING function, as used in this model, begins with the formal plan transmission and receipt of orders at subordinate units. Units receive these orders at the beginning of their "**DECIDE**" leg. Resources are allocated and forces are identified to meet tasking. When operations identified in the orders begin, the "**DECIDE**" leg is complete.

TO ACT - The "**ACT**" phase of the C^2 process, as shown in Figure 4, begins when actual battlefield tasks are executed. It involves the interface between the system being controlled and the battlefield environment (11:29). Feedback from the battlefield is also an essential part of this phase.

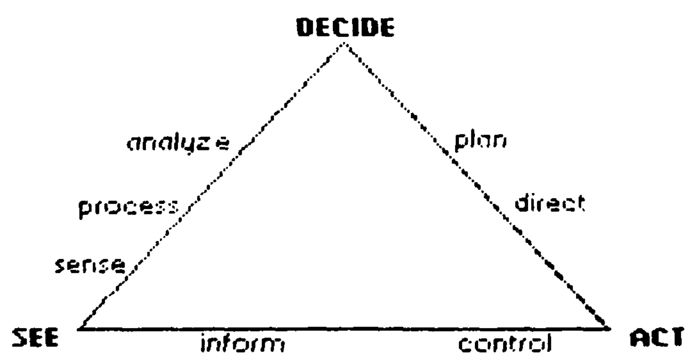

Figure 4

The level of centralized control and decentralized execution employed by the affected commanders has an obvious effect on the "**ACT**" phase, however, the actual C^2 tasks remain the same.

a. The CONTROL function includes monitoring and supervising the battle situation, comparing results with predictions and making necessary adjustments. The less the degree of local control, the less will be the flexibility of on-scene C^2 adjustments. The time-criticality and volume requirements of feedback take on added significance as the C^2 process becomes more centralized. Feedback provides the first assessment of on-going activity and is essential for redirecting forces and planning future operations.

b. The INFORM function occurs during battlefield operations but is aimed at future actions. It can be thought of as feedback oriented toward the next C^2 process cycle. Daily or other periodic reporting requirements are typical examples of this function. These types of reports and messages also guide the selection of intelligence collection for the next C^2 process cycle.

MULTIPLE PROCESSES - This review of the C^2 process cycle has, so far, considered only a single snapshot in time and space. But the process is always actually working over several days and at many levels.

Figure 5 on page 10 illustrates three days of C^2 activity. (While there is no hard and fast rule, a 24 hour period is a common C^2 process cycle.) As shown by the arrows, the **SEE** phase can impact on any of the three days depending on the time-criticality of the information. The **DECIDE** phase is mainly looking at "tomorrow's" war. The **ACT** phase impacts mostly on the next day's **SEE** phase. On any one day, the organization is thinking about two or perhaps three C^2 process days.

Figure 6 on page 10 illustrates the C^2 process in a multi-level environment. As the flow from the right leg of each triangle shows, the directing is mainly aimed at the beginning of the decide phase at the next lower level, although some effort is lateral (e. g. one component acting as Area Air Defense Commander tasking air assets of another component). The flow on the left leg of each triangle indicates the complete interrelation of the information collection phases.

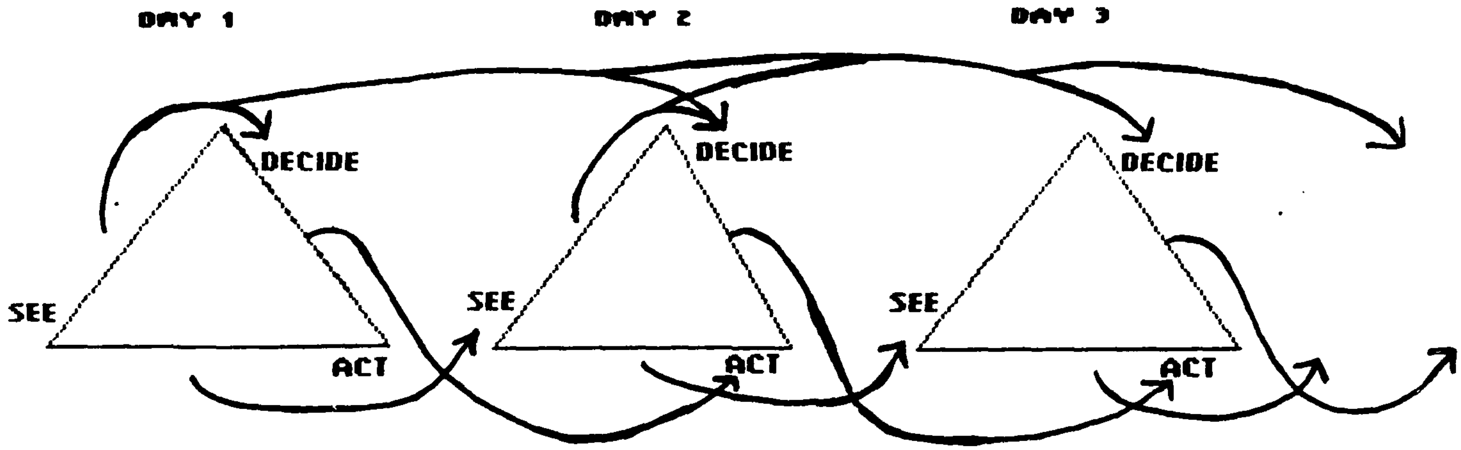

FIGURE 5

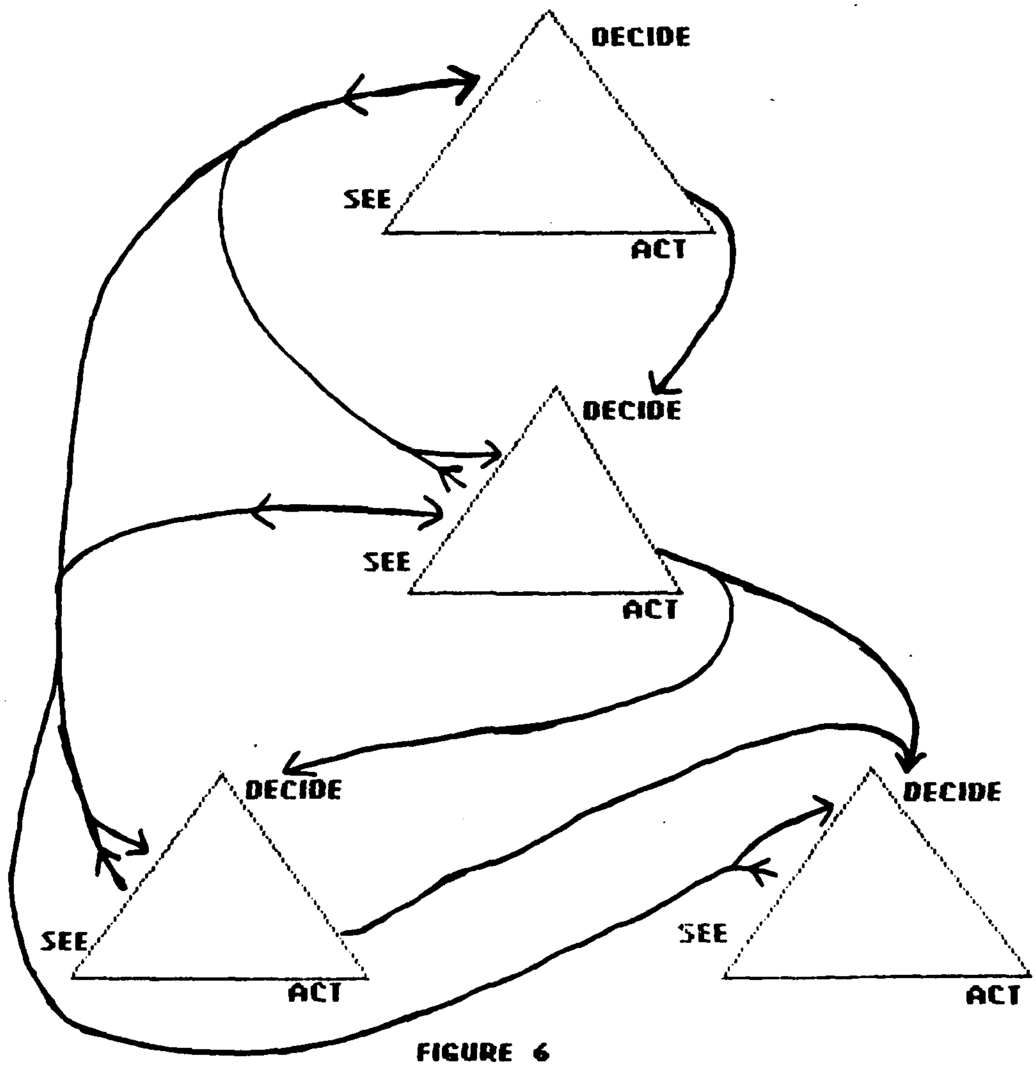

FIGURE 6

C2 SYSTEM

A C^2 system consists of "The facilities, equipment, communications, procedures, and personnel necessary to a commander . . ." (JCS Pub 1). As with the C^2 process just described, a C^2 system is much more complex than it first appears. A C^2 system is almost always a network of many systems. Since no two force structures are ever exactly the same, the C^2 systems to support them will also be different (13:9). In a nutshell, however, the C^2 system allows the commander to **SEE** the battlefield by providing the sensors, processing and analysis facilities, and communications links between them. The C^2 system also includes the command post(s) where the commander compares the real situation with the desired one and **DECIDES** where change is needed. After detailed planning, the orders and directives are transmitted to other units over C^2 system communications. While units **ACT** out the commander's orders, the C^2 system enables force control by providing communications links for feedback on force employment. The commander maintains flexibility by using C^2 communications links to redirect forces based on that feedback. As changes are made to intelligence collection and sensors are redirected to their next targets, the C^2 system continues to support the

"new" C^2 process cycle. This section describes some of the important C^2 system considerations critical to the C^2 process.

TO SEE - Facilities where these functions occur are not always colocated. When a process function is not colocated with its associated sensor, there is undoubtedly a communications link required with some measurable time delay involved. For example, an airborne sensor may have to downlink data to a ground processing station. In certain cases, the sensor platform must actually land for the data to be physically taken to the processing station. Further time delays may be added when processing locations are geographically separate from the analysis/fusion function. Some of the processing and some of the analysis could actually be done out-of-theater. This dispersion of facilities is driven by valid operational requirements but it does pose challenges to system users. The displaying of information can be a time-consuming art in itself. It is interesting to observe various C^2 systems to compare the amount of time spent collecting-processing-analyzing with the amount of time preparing and presenting briefings.

The next level of potential problems occurs when forces work in the joint or combined arena. Now the problems of facility dispersal and expanded communications link requirements are often compounded by

differing procedures and personnel training. (e. g. , How, where, and when is the Army ground map information (friendly and enemy) transferred to other Services? What differences exist between Services and agencies on the definition of "processed information"? What are the differing Service policies relating to what information is so time-sensitive that it can be released to commanders prior to being "analyzed"?) A most challenging problem for C^2 planners is how much intelligence data will be transferred between Services and agencies and at what level? Fortunately, many of the JCS Joint Exercises provide opportunities to experience these differences and learn how to overcome them.

A more challenging problem would be in a short-notice crisis situation that requires a joint task force (JTF) operation. In addition to all of the aforementioned challenges, less is usually known about the existing battlefield situation which drives sensing requirements way up. Time-compressed situations will especially stress those intelligence systems with longer sense-process-analyze cycle times. Some valuable information may not be usable if it isn't available prior to the appropriate point in the decision cycle. Finally, the JTF scenario (vice an existing command structure) does not always use forces that have worked together in joint operations or exercises previously. This lack of familiarization can lead to initial hesitancy, confusion and delays even beyond the normal "fog of war".

TO DECIDE – The commander makes decisions, not the C^2 system. No amount of high-volume, real-time communications can make a bad order a good one or turn ambiguous instructions into clear ones. Nor should the C^2 system be blamed for decisions that are made too late to have impact on the battle. The C^2 system is and should be accountable for providing effective decision aids and adequate communications for planners and for disseminating all orders and directives within established timelines and error rates. Command center and command post upgrades are happening almost constantly to provide automated data support and increased amounts of communications. The goal is to handle more information quicker. The heat of battle is no time to realize that the right information is not available to make a decision or to find out that you can't talk with another component's headquarters because you don't have the same cryptographic device or key.

Another challenge for the C^2 system is to be able to get information to and from the commander no matter where that may be and under high threat conditions. A C^2 system must be flexible and survivable enough to function effectively in a variety of geographical circumstances and with potentially changing command relationships. This usually requires such things as physical security and protection, redundant transmission media, alternate routings, backup communications nets, backup communications

means and distributive networking schemes. With all this sophistication, the C^2 system user's key questions are still, "Who do I want to talk to (unit designator/callsign)?" and "What is their address and number (plain language address/tactical telephone number/communications net/ frequency)?" The C^2 system staff is normally responsible for setting up a flexible network. The commander flexes it by moving units, activating and deactivating nets, and directing use of changing callsigns or backup means. Finally, the C^2 system must have enough throughput capacity to transmit the tasking orders within appropriate time standards.

" *Now the whole earth used the same language and the same words. . . Come, let Us go down and there confuse their language, that they may not understand one another's speech' . . Therefore its name was called Babel* "(Genesis 11:1-9)

The joint and combined arena immediately raises the red flag of interoperability. Yet, in a generic sense, interoperability is not only a joint issue. When one flight of USAF F-16s joins on to another flight of USAF F-16s, but neither flight knows the other's radio frequency, that is a procedural interoperability problem. When a flight of F-16s can't talk to a ground force of another nation because neither knows the other's radio frequency, that is the same interoperability problem, but now it is joint. If, in either case, they can't talk because they have radios in different

frequency bands, then that is an equipment interoperability problem. The difference is important. A procedural problem can normally be corrected most easily by a procedural fix; an equipment problem by an equipment fix. Trying to fix procedural problems with equipment doesn't address the real cause.

Common equipment can help interoperability, but it can't ensure interoperability. Even using equipment of the same make and model won't ensure interoperability. A common language, common procedures, common tactics, common doctrine and, especially in the case of new digital and automated equipment, common standards are also required to reduce interoperability challenges (7:20). Additionally, it would not be a smart operational decision to try to take this idea to the extreme and put everyone on one frequency and one net. There are good operational and technical reasons why some units need high frequency (HF) long range connectivity in voice and data, while others prefer the short range of very high frequency (VHF) with frequency modulation (FM). Due to tactics and doctrine, some air forces use ultra high frequency (UHF) voice while others use UHF data. Most everyone would like satellite radios but satellite capacity is very limited. And if all that wasn't enough, probably the toughest area to resolve is cryptographic devices and materials.

We must strive for interoperable equipment but never presume it will happen. Turnover of systems is too dynamic. By the time one

system is almost fully fielded, a new system has just entered the inventory. But working toward commonality does help give C^2 system planners more flexibility. While we are unlikely to achieve full interoperability, we must still "enable [forces] to operate effectively together". That type of interoperability requires getting the right participants on the right command nets with the correct frequencies and the correct cryptographic devices and materials. As a former JCS/J-6 said, "it takes planning and logistics support in addition to compatible equipment sets to achieve interoperability." (7:19). Said another way, proper prior planning prevents poor performance - or simply "P^6". These points will be further explored in a later section.

If these issues weren't problems enough, what happens when everything occurs in a hurry? Crises are occurring more frequently, almost six per year in this decade. Further, more than 80 percent of them happened away from U. S. forces garrison locations so that whatever forces were used had to bring in their own C^2 systems (4:51). These crises have also normally unfolded rapidly and are planned in strict security. All of this further complicates C^2 system planning in crisis situations.

TO ACT - "Because modern communications are relatively independent of distances, during a crisis or contingency situation, too many people use the radio and telephone." (1:21).

Modern technology has given the C^2 system the capability for direct communications from national command authorities to executing elements on the battlefield. The potential for high-level micro-management is obvious. Senior leaders must learn to deal with these capabilities without inhibiting decentralized execution authority or subordinate's latitude. Happily, two notable recent operations (Grenada in 1983 and Libya in 1986) are both examples of higher headquarters self-discipline that avoided oversupervision of JTF commanders (15:17). There is a recognized, valid requirement for feedback up the chain of command. As a matter of fact, the commander of the JTF for Grenada (Vice Admiral Metcalf) felt that the key to retaining local control was the continuous feedback to higher headquarters (5:285). The point is to continue the monitoring function without stifling local initiative and aggressiveness. The same balance is required for all levels of combat described in this paper. One of the items that can make a big impact in a JTF environment is a commander's approach to this balance. In an existing command structure, a commander's style has already personalized the associated C^2 system. A

crisis operation rarely allows this, so significant changes may be required in the C^2 system during early stages of a JTF-run crisis operation.

MULTIPLE PROCESSES – One additional requirement for a C^2 system – the need for backup command headquarters – stresses both manpower and communications resources. In many situations, a single unit might have a main command post (CP), an alternate CP (often located in a rear area), a tactical CP closer to the battle area, and an airborne CP. A C^2 system must provide the right facilities and then link them all together. Think of each of those triangles in Figure 6 as four deep and then imagine providing all of the communications links to connect any one of the four to any other one of any other four!

MAKING IT WORK BETTER

A short-notice crisis/contingency that requires the establishment of a JTF will be used to describe those C^2 system features that make the joint C^2 process work effectively and efficiently. Even though this short-notice JTF scenario may offer the biggest C^2 challenge (due mainly to short planning time and unfamiliarity between units), these same system features are necessary throughout the spectrum of conflict. These same features are also critical in combined operations.

TO SEE - One of the very first requirements for the commander of a JTF (CJTF) is to develop a capability to manage joint intelligence collection. The assets of any Service component or nation attempt to optimize against likely opponents. If the joint environment is to achieve any synergism, then strengths from each participant must be used to protect vulnerabilities of any other ally or sister component. Further, these scarce collection resources must be used with maximum efficiency and effectiveness. This strongly encourages the use of a joint collection priority plan. Armed with such a priority plan and equipped with corporate knowledge (through liaison officials) of each JTF component's capabilities, a collection management scheme can intelligently align sensor targeting. Sensors with more rapid servicing capabilities, those with

higher accuracy, and others with unique coverages can be more effectively tasked against a joint target priority list that identifies those needs. From the very beginning of a low-level contingency to the continuous vigilance of strategic deterrence, assets of every component or allied nation must be used in the best possible manner for effective collections and total coverage. After joint collection tasks are completed, then the follow-on need arises for joint intelligence fusion.

Commanders at all levels require the most complete intelligence picture possible. Centralized focal points must provide commanders with all-source information in time to be useful. The challenges here are multi-faceted. First, the information sources must be identified. Then, the bureaucratic arrangements must be developed for what information will be made available and when and how. Following that arrangement, the connecting links are established between systems. (If this seems too simplistic, consider the severe stress on intelligence in a short-notice crisis operation in an out-of-the-way place like Grenada.) It should be a primary C^2 task to establish a location for intelligence fusion and provide necessary communications links for all-source information.

TO DECIDE - Target selection is one of the first items of business in any operation and at all levels of conflict. Target importance shifts dramatically as the battlefield scenarios change. Even during deliberate

planning, it is important to provide sufficient planning guidance to components on target priorities based on JTF objectives. It is also critical in the joint and combined arena to develop a joint targeting panel to coordinate and integrate the targeting efforts of all components, including special operations forces (14:). This joint panel should meet as early as possible in the planning process to establish target priorities and ensure that the most effective weapons system is applied to the target (i.e. bombs, jamming, deception, listen instead of destroy) by the most appropriate component or country. Intelligent target selection must then be followed by effective dissemination of tasking messages.

Many of our existing hard copy message communications and distribution systems have developed very powerful, high-volume transmission and processing capabilities to be used at higher-level headquarters. Unfortunately, a number of lower-level units that have to act on these messages have small spigots and little to no processing support. This situation is often made worse by the very large amounts of information included in messages such as fragmentary orders, situation reports and air tasking orders. When messages back up or aren't delivered as soon as desired, we blame "the system". Nonsense!

The solution is a blend of message reduction, procedural standardization, and a more visible communications architecture. Better

message discipline can reduce volume to an acceptable level. Command emphasis and example are needed to get message length cut back, total message numbers reduced, and precedence inflation corrected. A message review board, chaired by a senior commander's representative, is an effective method to get such action started. Another effective approach is to shift some of the workload to electronic mail features in theater computer networks. In a major exercise series in Korea (ULCHI-FOCUS LENS), for example, AUTODIN message traffic was reduced from 58,000 in 1984 to 4,000 in 1987 by using a local computer network (9:32). When these actions are in place, truly critical messages get highlighted and are delivered quickly. C^2 procedural standardization such as using JCS Pub 25 (U. S. Message Text Formats) is a positive step toward having common formats and terms for the highest command authorities and the lowest execution element across joint and allied lines. More message formats should be brought under this concept.

National communications architecture must also be comprehensive enough to develop and enforce interoperability standards for tactical entry into fixed Defense Communications Systems (DCS) equipment. Technical interoperability standards are also needed for such vital areas as COMSEC, jam-resistance equipment, and computer sustems protocol.

A more philosophical C^2 approach would be to apply some of the "Nelsonian Touch" by conveying *senior commanders' plans and concepts* to subordinates ahead of battle and do it so clearly that, during critical combat, communication requirements are greatly lessened (12:110).

One final point. After any or all of these needed enhancements are in place, frequent practice and education are essential to keep these interfaces working properly. Familiarity, in this case, breeds success.

TO ACT - No two commanders will use a C^2 system the same way. However, there are three specific areas where improvements can be *made to help achieve that old* P^6 and give commanders needed flexibility during operations. They are generic joint communications planning, joint communications packaging and frequent practice. These items apply both to the **DECIDE** and **ACT** phases, but they are included here because of the direct impact and high visibility they receive during combat situations.

A fundamental characteristic of good communications planning at all levels - - national, theater, or unit - - is thorough detail. Communications planning, even for concept plans or emergency dispersal and reconstitution plans, must begin with an understanding of which facility

will do what C^2 process function. This should be the primary basis for determining C^2 connectivity requirements. (Figure 6 with multiple command facilities for each unit suggests the complexity of this task.) Next, decide on the required number of nets and net function (command, operations, intelligence, logistics, administration, airspace coordination, airspace management, etc.,) and who should be on them. Following those decisions, the specific communications media (HF, UHF satellite, SHF satellite, etc.), COMSEC equipment and associated materials can be developed based mainly on type of information to be passed, unit locations, and equipment availability. Until communications planning is taken to this detail, the capability to accurately determine equipment weaknesses and shortfalls is very limited. Following these determinations, actual frequencies, callsigns, etc., would be assigned and listed in the communications document. Said another way, if the Annex K to your OPlan or CONPlan doesn't include this information, then the planning is not complete. This process is equally valid for connecting a dispersed national command authority with relocated Service headquarters and Unified/Specified commands following a global nuclear attack or a short-notice crisis contingency operations that requires the rapid constitution of a JTF.

Joint communications packaging simplifies the planner's task by providing a pre-coordinated, pre-published and pre-distributed joint communications-electronics operating instruction (JCEOI). A JCEOI is especially necessary in short-notice contingency operations when units that do not normally interface are brought together to fight. Under these conditions, it may not be possible to develop, publish and distribute a JCEOI to all required levels prior to deployment into an operation (6:11). Naturally, each Unified commander can, and probably should, develop a similar contingency communications plan for anticipated operations within their area. Still, a world-wide deployed package should be developed under the sponsorship of one of the Unified commands and include, at a minimum, contingency radio nets, frequencies, callsigns, COMSEC equipment and keying materials for conventional and special forces. Once that document is developed, it should be included in the Intertheater Command, Control and Communications (C3) COMSEC Package (ICP) that is administered by USCENTCOM for use by all unified and specified commands. This action would give high visibility to the existence of such a document and make it available to be included in the appropriate unit COMSEC accounts prior to its being needed.

Another key to an effective command and control capability is frequent practice. Even with common equipment and common procedures, periodic joint and combined exercises are necessary to train new people

and refresh those who are more experienced. This training may be even more critical for higher-level organizations than for combat units simply because training at the higher levels tends to be done less often and under less realistic combat or crisis conditions. What is needed is more attention to crisis planning and short-notice joint training exercises that stress staffs and C^2 systems at all levels. The JCS No-Notice Interoperability Exercise Program (NIEX) (10:--) has begun to fulfill that role. This program exercises joint planning staffs in realistic crisis scenarios, stressing interoperability and short-notice planning capability.

A QUICK LOOK BACK - Just over 200 years ago, the British Navy expanded their use of visual signals and began to emphasize centralized control over battle engagements. As a result, in the minds of some observers, communications became a substitute for good command and control(12:106). Lord Nelson rejected the use of communications as the answer to C^2 problems. Instead, he developed a decentralized philosophy in which he relayed battle plans during face-to-face meetings with his subordinates. He wanted them to understand clearly what his goals were, but he let them decide how best to carry out their missions. He felt that commanders who knew the overall battle plan well and were allowed maximum freedom in the engagement were better equipped to handle the fog and confusion of actual battle.

Great strides have certainly been made in communications technology since Nelson's time. Today, we again find people looking for communications fixes to C^2 problems. Yet, the fog of today's battles seems just as challenging as ever. Overdependence on communications links with higher headquarters may be even further clouded by recent major efforts on the part of friendly and enemy forces to attack and defeat C^2 systems. Communications are sure to be disrupted and major units will find themselves isolated for extended periods.

The best answers remain the same as Nelson's. Decentralize command and control as much as possible by indoctrinating subordinate commanders with clear understanding of the mission and then allow them to act on their own initiative. Use communications to convey C^2 process actions, not as a substitute for C^2 vision. Commanders who are able to maintain effective C^2 by having the overall battle plan firmly implanted at all levels will have a decided advantage over their opponents.

SUMMARY

Interoperable joint C^2 procedures and systems are essential to effective joint and combined warfighting today. Much of the recent

attention to "fixing" C^2 problems, however, has been devoted to symptoms (equipment) rather than causes (architecture and procedure). A broader approach is needed that emphasizes the C^2 process and P^6.

This paper has described essential elements of the C^2 process - - **SEE, DECIDE, ACT** - - through a C^2 functions model and related the process to a generic C^2 system. With this background, needed enhancements are clearer. Integrating units from several Services and countries into a cohesive fighting force requires common procedures, tactics and terminology plus a good appreciation of Service-unique areas. Providing competent, knowledgeable liaison people is an important way to resolve misunderstandings. Exercising in realistic environments is essential to bring all available capabilities together, give everyone the confidence to employ units in their most effective ways, and deliver the best possible fighting force.

To be effective in war, joint C^2 must work in peace. Improvements are needed in joint C^2 procedures, architecture, and communications planning as well as equipment interoperability. Realistic joint exercises provide the best vehicle to hone skills and validate enhancements. It will be too late to find and fix joint C^2 problems in the middle of the next conflict.

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